DOCUMENT RESUME

ED 479 585 IR 022 189

AUTHOR	Monthienvichienchai, Rachada; Sasse, M. Angela
TITLE	Computer Support for Vicarious Learning.
PUB DATE	2002-10-00
NOTE	9p.; In: E-Learn 2002 World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education. Proceedings (7th, Montreal, Quebec, Canada, October 15-19, 2002); see IR 022 093.
AVAILABLE FROM	Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: http://www.aace.org/DL/.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS
DESCRIPTORS	*Computer Assisted Instruction; Computer Software Development; Computer Uses in Education; *Cooperative Learning; *Courseware; *Educational Technology; Higher Education; *Instructional Materials; Material Development; Programming
IDENTIFIERS	*Digital Video Interactive; *Vicarious Participation

ABSTRACT

This paper investigates how computer support for vicarious learning can be implemented by taking a principled approach to selecting and combining different media to capture educational dialogues. The main goal is to create vicarious learning materials of appropriate pedagogic content and production quality, and at the same time minimize the financial cost and effort to produce such materials. This paper proposes that multimedia and television production principles can be harnessed for this purpose. The paper reports results of two case studies on collaborative learning of television production in communication arts and diagrams construction in computer science and analyzes the problems encountered in the production and use of the vicarious learning materials created. The paper concludes that, if vicarious learning is to be implemented, the problems that "educationalists" face in creating appropriate materials need urgent attention. (Contains 19 references.) (Author)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 479 585

Computer Support for Vicarious Learning

Rachada Monthienvichienchai
M. Angela Sasse
Department of Computer Science, University College London, Gower Street, London, WC1E, UK
+44 (0) 20 7679 3039
P.Monthien@cs.ucl.ac.uk and A.Sasse@cs.ucl.ac.uk

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

G.H. Marks

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Abstract: This paper investigates how computer support for vicarious learning can be implemented by taking a principled approach to selecting and combining different media to capture educational dialogues. The main goal is to create vicarious learning materials of appropriate pedagogic content and production quality, and at the same time minimise the financial cost and effort to produce such materials. We propose that multimedia and television production principles can be harnessed for this purpose. We report the results of 2 case studies on collaborative learning of television production in communication arts and diagram construction in computer science and analyse the problems encountered in the production and use of the vicarious learning materials created. We conclude that, if vicarious learning is to be implemented, the problems that educationalists face in creating appropriate materials needs urgent attention.

Keywords: courseware authoring, vicarious learning, collaborative learning, digital video, higher education.

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Introduction

What is Vicarious Learning?

Vicarious learning (VL) is learning that takes place when one learner observes an educational dialogue between a tutor/lecturer and another learner (Mayes & Fowler 1999). In previous studies of vicarious learning, the evaluation criteria were entirely pedagogical, such as assessing the effectiveness of VL materials (Lee et al. 1999; McKendree et al. 1998; Stenning et al. 1999) and whether VL promotes learning (Lee et al. 1998). The research reported in this paper builds on these studies, and extends them to consider how best to implement computer support for vicarious learning (CSVL). The main goal of our research is to create tool support for VL materials that contain the appropriate pedagogic and production quality, and can be delivered with the skills, resources and equipment available to most educators.

What makes CSVL different from a video?

The main advantages of supporting the production and access of vicarious learning material via computers as digital video (DV) over conventional video are:

1. the ability to integrate this resource with other online learning materials – DV can contain URLs to online lecture notes or relevant online formative/summative assessment modules and
2. the possibility of personalising the learning material.
3. DV can be divided into chapters that are much easier to navigate through than conventional analogue video.

As real life interactions will be recorded, students will be able to relate directly to problems that they and their colleagues are having during that academic year. In the simplest form, CSVL allows students to revisit their collaborative attempts at tackling a problem. Such revisits strengthen their understanding of the topic by promoting the use of *episodic memory* (Tulving 1983). Episodic memory is a person's personal memory encoded with respect to specific time and place, i.e., remembering the lecturer explaining what episodic memory is on a hot summer afternoon in his/her office. Such memory is more resistant to forgetting. Additionally, students will also be able to view other groups' attempts at tackling the same or similar problems by either accessing materials from the current or previous academic years.

IR022189

Producing VL Materials

The main aim of our research is to produce a design specification for a cost-effective CSVL system that can be easily implemented by individual or small groups of educators and is flexible enough to accommodate the specific needs of their teaching topics and student cohorts. The system also needs to be

BEST COPY AVAILABLE

flexible enough to support installation in small rooms (individual tutorial) and medium-size rooms (group tutorials).

Why focus on these implementations of CSVL? VL has been shown to be effective in professional productions, e.g., Open University education programs containing brainstorming and debates between lecturers and students and public debates often discussing issues concerning current affairs. However, a lecturer who wants to use such programs can face several obstacles. Firstly, the content of the program may not suit the need of the students/courses that the lecturer is teaching. Secondly, the materials are not grounded in the students' own experience and therefore do benefit from the effects of episodic memory. Professional productions are also costly and require large amount of time and effort from a lecturer who wants to produce similar material. For this reason, our research is asking whether computer support can bring the benefits of VL to individual lecturers. If so, how can it be done? If not, what are the main obstacles?

Pedagogic Design

VL can form parts of various pedagogic designs. Since the main aim of our research is to investigate the various aspects of technology used for implementing VL, the Laurillard's model of learning (Laurillard 2002) was adopted and maintained through out for consistency. In this case, VL forms part of the on going negotiation of meaning between the lecturer and the students. A simplified diagram of this model is given below.

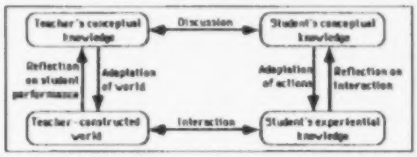

Figure 1: Simplified diagram of Laurillard's Model of Learning (Pennel 1996)

Another model of learning which may also be applicable is Wenger's Learning Architecture Model (Wenger & Snyder 2000), where students are working towards being part of a community of practice, in this particular case, the community of systems analysts and IT developers.

Perceived quality of production matters – a pilot study

Most video-based VL systems consist of video recordings of the interactions between lecturers and students, accompanied by notes on the topic under discussions, and perhaps the page of the lecture notes on the topic. Two such examples are The Dissemination System[1] used at Heriot-Watt University and a similar one at University of Edinburgh[2]. Both systems are used for teaching Human-Computer Interaction (HCI) courses. On the other end of the spectrum, the Classroom2000 project[3] at Georgia Institute of Technology demonstrates what high-quality recording and dissemination technology can deliver. By combining video/audio recording with time-stamped slides and annotation, the Classroom2000 project has managed to put the essence of a lecture online. However, this emphasis of putting lectures online means that Classroom2000 does not focus on student actions and feedback, which is essential for VL. Additionally, the system, requiring expensive equipment, is not cost-effective to implement in individual lecturer's or small tutorial rooms.

A pilot study was conducted to see how a simple production of a single-camera recording a tutorial session be perceived. Computer science students were shown some samples of videos containing vicarious learning resources and were asked to make general comments about them. In each video, a lecturer and a student have a staged dialogue on general HCI topics while seated around a table. At various points, either the lecturer or the student would refer to materials on pieces of paper or the whiteboard. The video was produced using a single static-angle video camera and, after encoding into RealMedia streaming format, shown on a 1-inch in diagonal window supported by mono sound. Some of the most prominent comments from the students concerning such a production were:

1. Poor sound quality made it very difficult to understand what each person was saying.
2. The video was so small and blurry that there was "little point in it being there".
3. It was impossible to see what was written on the whiteboard or the pieces of paper on the tabletop.

[1] http://www.hcrc.ed.ac.uk/Vicar/TT/
[2] http://www.cogsci.ed.ac.uk/school/study/ug/hc1h/
[3] http://www.cc.gatech.edu/fce/eclass/index.html

BEST COPY AVAILABLE

4. The content was perceived as "deadly dull."
5. It was hard work going through each video and picking out what the main message was.
6. Students said they would be reluctant to refer to such material, they would prefer to use lecture notes and books.

The pilot study revealed that the perceived quality of the material not only affects comprehension of the content being offered, but also its perceived practicality, i.e., whether such resource will be used or not. A previous study of real-time multimedia in a distance education context (Watson & Sasse 2000) found that perceived quality of materials can be affected by unsatisfactory audio quality resulting from incorrect setup of end-system audio hardware and equipment setup, rather than by network effects such as packet loss and jitter. Comments from students in this pilot study showed that perceived quality of recorded material can be similarly affected by insufficient end-system video hardware and incorrect equipment setup.

How to make a difference?

So what affects the perceived quality of video-based vicarious learning materials? This case study looks at the student's perception of the quality of materials in comparison with other materials such as lecture handouts, books and self-made notes. Audio/visual production variables play a crucial role in the perceived quality of the final material, We wanted to determine which variables affect students' perception of the quality of recorded instructional material, and to what extent.

Multimedia Production Principles

Reeves and Nass (1996) identified a number of factors that can influence the perception of multimedia material. In our view, the following are particularly relevant to authoring video-based multimedia:

1. **Image size:** larger images are evaluated more positively than smaller ones and better capture the viewer's attention. Additionally, content on larger images are better remembered than those on smaller ones.
2. **Fidelity:** sound quality was found to have more impact on the viewer's perception of the quality of the material being shown. More importantly, audio fidelity was found to affect attention to media and the viewer's memory for audio information.
3. **Synchrony:** viewers of videos containing audio-video asynchrony commented that people in the video were "less interesting, less pleasant, less influential, more agitated, and less successful in their delivery" than those in synchronized video. This is very significant, as educational materials should not have any of the attributes that have just been mentioned.
4. **Scene Changes:** scene changes can be used to provide structural cues to direct the viewer's attention as well as serving as markers in the viewer's memory. In order to create appropriate cuts and scene changes without using cameramen, it will be necessary to use more than one camera to capture the discussion.

Television Production Principles

Guidelines from the area of communication arts (or media studies) suggest that the number of camera angles also affect the viewer's perception of the quality of the production. The two main factors that have not already been mentioned are:

1. **Shot Selection:** Multimedia principles already point out that, if the production will be viewed in small windows, the camera should close in on the speakers to create the sensation of larger size. Television production principles add to this several points concerning the placement of cameras and how speakers should appear on screen (shot selection). These ranges from wide-angle shots used for orientation of the viewer to over-shoulder shots for suggesting relationship between speakers. Overall there are around seven main shots that can be used during an interview each with specific purpose (Armer 1990). Specifically in the context of this case study, it is also important to make sure that the camera shots that are used allow a clear view of any artifacts – such as models or drawings.
2. **Number of Cameras:** As well as shot selection, the number of cameras also influences the quality and style of production (Watts 1997). Single camera productions require a camera operator that can skillfully move around the set in order to film each speaker as he/she speaks without any obvious interruptions. In a two-camera production, camera movements are greatly reduced by "cross-shooting" (the field of vision of each camera appear to cross). Additionally, the camera operator can zoom in or out to get extra "over-the-shoulder" shots. However, if a third camera is introduced, the job of the camera operator becomes minimal or nonexistent. That is, it is possible to create all the necessary shots

with three cameras for an interview situation. If no camera operators are required, materials can be created without the camera crew associated with traditional video productions

Post-production Issues

In addition to multimedia and television production variables, there are some post-production design issues that may also affect the student's perception of quality. Compared with text, video and audio are slow media for transmitting information – reading a book yourself is much quicker than having it read to you. It is therefore necessary to provide navigational support to allow students to quickly access certain part of the material, without having to go through the entire content of the material.

Too Many Cameras?

Case Study 1 – TV Production Course, St. John's University, Bangkok, Thailand

According to television production principles, increasing the number of cameras will increase quality of production. *But is there a point of diminishing return?* In terms of return on investment, is the amount of information captured that much better when using three cameras than one?

An experiment was conducted to investigate how increasing the number of camera angles in video productions affects the students' perception of the quality of the production. Three cameras were used to capture 3rd year undergraduate communication arts students producing their first television program. Lecturers in this discipline usually introduce students to the theories of producing a "show" in the classroom, but it is difficult to teach students how things actually work or relate to each other in the studio. The aim of the video was to show fellow students the dynamics and the dialogues that go on within the control room – problems that other students encounter, how they solved them and how they make decisions within the group to accept certain takes. The point of the video is to minimize the amount of time students spend inside the studio learning how to produce a show rather than actually producing one. As studio time is rare and expensive, this will allow students to make better use of their studio time.

Experimental Setup

The production session takes place in two adjacent rooms – the control room and the studio. The producer, director, soundman, switcher and computer graphics supervisor work in the control room while actors, cameramen and stage manager work in the studio. It is the action in the control room that are of direct pedagogic relevance for this production, but the actions in the studio are also relevant in the wider pedagogic context. Three cameras were setup to capture the student's production session. The aim is to create for the experiment *three productions that differ only in the number of camera angles that are used.* Consequently, it was necessary to produce the three productions from just a single take to ensure that the content of the productions are identical. Each camera was positioned as follows:

Camera 1: Wide angle shot inside the control room with each person and control equipments visible. Each person has his/her back towards the camera as they are working on the equipments within the room. Additionally, a small portion of the studio room was also visible.

Camera 2: Wide angle shot inside the studio itself. This camera captures the actors, cameramen and stage manager

Camera 3: Close up shot of each person inside the control room. Each person face, in contrast to camera 1's angle, is now visible.

Figure 2: Screenshots showing the three camera angles used in the experiment (including PIP insert)

In addition to these three camera angles, it was possible to add another angle, which was drawn from the actual production that the students were creating – i.e., the show that they were making – this was presented as a picture-in-picture (PIP) insert. This is similar to being able to see what people are writing while they have a discussion around a whiteboard. From these three cameras and the PIP insert from the student's production, the following productions were created:

Production	Camera 1	Camera 2	Camera 3	PIP
1	X			
2	X			X
3	X	X		X
4	X	X	X	X

The productions are ordered according to the amount of effort it would take a lecturer to edit each production, where production 1 requires the least amount of effort. Once all the necessary productions have been created, twenty-one students were grouped into three focus groups. Each group viewed the following productions:

Focus Group	Prod.1	Prod.2	Prod.3	Prod.4
1	X	X		
2		X	X	
3			X	X

Students were not directly prompted to comment about the quality of the video but instead were first asked whether there were any differences between the two video productions.

Summary of Results

The transcripts of each focus group were analysed in terms of comments that the students made specifically about the quality of each production. There were significant differences in terms of perceived quality between production 1 and production 2, and between production 2 and 3. In both cases, increasing the number of camera angles resulted in the students thinking that the quality of the production had been improved. However, there were no perceived improvements in quality when moving from production 3 to production 4. As a matter of fact, focus group 3 actually said that production 4 was 'more boring than production 3'. This indicates that *while increasing the number of cameras does not always increase the perceived quality of the production, the number of cameras used does affect the viewer's perception of production quality.* The result suggests that the optimum setup for this particular case would be to use two cameras to capture the dialogue and one PIP insert to keep track of what the students are doing with props.

Analysis of Results

Why did the addition of another camera in production 4 not increase the perceived quality of the production? When breaking down the content of the video in terms of the Laurillard's model of learning, a pattern has emerged. If the content of each production is categorised in terms of the stages of interactions in the model, each additional camera angle in successive productions adds another stage of interaction of the model to the production – all except in the case of production 4. Production 2 adds the result of the student action, production 3 adds the actual action of the students in the studio, but production 4, while adding another camera angle, does not add a stage of interaction that has not already been covered by previous productions.

Consequently, in order to determine how many cameras will be needed to effectively capture a situation for use as vicarious learning material, it is necessary to *first identify what actions correspond to which part of Laurillard's model, and then implement the necessary technology to capture those actions.* For example, a 1-camera setup will be as pedagogically effective as a 2-camera setup when capturing a student and a lecturer talking about a concept, but a 2-camera setup will be more pedagogically effective should any written materials be introduced into the discussion.

Capturing Dialogues in the Real World

Vicarious Learning and Computer Science Education

Diagram construction is a major part in the syllabus of computer science and information technology students. Each year, students find it difficult to learn how to construct system models such as entity-relationship or UML diagrams. To help the students, many lecturers show common mistakes in diagrams constructed by students in previous years. But since the process of constructing such a diagram involves more than the finished product can communicate, most students acquire the ability to construct such diagrams only after several attempts of their own, with feedback from the lecturer. This type of feedback – delivered 1-to-1 or in small groups – is very demanding on lecturers' time. To get more learning revenue from this time-consuming process, the tutorial sessions were captured as digital videos, and integrated into course notes and online computer-aided assessment (CAA) system. In effect, students who are not present in

BEST COPY AVAILABLE

the tutorial can vicariously learn the same material and more through this setup. Students can also acquire necessary skills by observing one of their colleagues constructing a diagram or, more often, by collaboratively constructing the diagram as a group. Additionally, if dialogues between the student(s) and the tutor/lecturer can be captured during an attempt at constructing a diagram, students who were not present will not only see the resulting mistakes but also how and why the mistake came about in the first place and of course, the reasoning behind constructing the final correct diagram as well! Hence, this particular case study looks at how best to produce Digital Video-based (DV-based) vicarious learning materials for teaching diagram construction in the field of computer science and what kind of problems lecturers face when producing video-based for such a course.

Case Study 2 – Systems Analysis and Design Course, University College London, UK

What kind of problems do lecturers really encounter when creating their own video-based materials? In order to investigate this issue, a case study was conducted. Rather than start from scratch, the system used was based on current knowledge of what is required to produce good quality video-based materials. A lecturer's room has been setup with the following equipments so that tutorials can be captured:

1. 3 digital video cameras
2. 1 MIMIO (see reference) electronic whiteboard
3. 1 Intel-based and 1 PowerPC-based PCs configured for DV-editing and whiteboard content capture
4. 1 Intel-based PC configured as a streaming video server
5. 1 high quality omnidirectional microphone
6. 1 document scanner.

So far, the total cost of the system is under $10,000. While it has less functionality than Classroom2000, it is only one tenth of the cost.

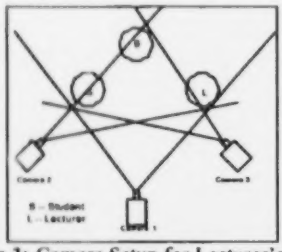

Figure 3: Camera Setup for Lecturer's Room

Problems with Capturing Real Educational Dialogues

Capturing real (as opposed to scripted) educational dialogues presents significant problems in terms of the pedagogic content of the captured material and the task of video-editing.

Pedagogic content

In a small-group discussion (1 lecturer and 2 students), the written materials referred to are often on paper, not on whiteboard as in the materials in the Dissemination System (see reference). Students bring their work on paper, and discussions and amendments centre around the pieces of paper on the desktop. Desktop and surrounding cameras did not get a good angle on the content of paper – even at close range both physically and through zooming. It was very difficult or impossible to make out what is being written on the pieces of paper in sufficient detail. Why is the whiteboard not used in this instance? The ReLaTe project (see reference) found that the use of the whiteboard is in the "tutor's domain". Students are reluctant to "expose" their work on the whiteboard and prefer the familiarity of their own paper (Hughes & Sasse 1997). For students, writing on the whiteboard means publishing their work, which they must be prepared to defend. Additionally, unscripted real world dialogues take time to get going – there are often periods of silence when discussion materials or off-topic chats.

Video editing

In order to produce good quality material, captured tutorial sessions need to be edited. Off-line editing of captured dialogue is the most time consuming task in the process of creating CSVL. It was necessary to first listen to a 5 or 6 second segment of a clip to determine which camera angle to use, then repeat this process until the end of the clip is reached. This "stop-go" approach is very time-consuming and

BEST COPY AVAILABLE

not practical for a lecturer to do. TV studios do real time (live) editing where the producer or director makes the decision to "switch" cameras while the production continues to roll. This "studio" style of creating the final production would be much easier and less time-consuming for the lecturer. However, an individual educator cannot afford dedicated staff to support each captured session.

Implication for Design

This section presents the conclusions derived from the pilot study and the two case studies in terms of what educational users need and what tools are required to provide sufficient support for producing video-based educational materials.

So, what constitute the "ideal" video-based vicarious learning material? Together with the previous findings from the literature and the case studies conducted, the following attributes have be derived:

1. The size of the video should be at least 360x288 pixels (1/2 DV) in a 1024x768 screen resolution.
2. The audio should be captured at 16-bits stereo audio ,sampled at 48kHz.
3. Maintain audio-video synchrony.

However, these attributes are often dictated by the bandwidth that is available while viewing the material online and therefore will be more of a design constraint rather than a design feature. In contrast, the following features can be incorporated irrespective of bandwidth size:

4. Cuts and scene changes can be controlled and incorporated by design into productions.
5. Cuts or scene changes should be used to create structure within the production as well as keeping the viewer's attention at the appropriate level – more than one camera will be required and each camera will need to be placed in the appropriate position to obtain the best possible angle
6. The video must incorporate camera angles that give the viewer sufficient access to props.
7. Allow the viewer to navigate through the video with respect to a clear pedagogic framework.

Derived system requirements

A system that efficiently supports production of video-based educational multimedia must enable the author to create materials with the greatest degree of quality while minimizing the amount of time and effort required to create those materials, i.e., it must be practical to use.

A survey of the current range of video-editing suites reveals that there are no packages that efficiently support, in terms of time and effort required, the task of authoring in-house video-based educational multimedia. Apple's iMovie is very easy to use but does not support the ability to have more than one synchronized camera angle to choose from at any one moment.

While Adobe Premiere and Apple's Final Cut Pro support multiple camera angles, they do not allow the author to choose camera angles "studio" style in post-production. Both packages force the user to use the "stop-go" approach to video editing. A system is required that can:

1. simultaneously capture DV footage from more than one camera
2. play each captured camera angle (video file) at the same time (once they've all been downloaded and synchronized) so that the author can see exactly what each camera has captured
3. allow the author to choose which camera to use in real-time without having to stop the videos being played (as if the production is being made live in a studio). This task should be as simple as clicking on the camera angle that is wanted at that time to switch to that camera in the final production.

This will critically improve the usability of video-editing systems in three major ways:

1. The pre-editing time will be cut substantially if footages from different cameras can be downloaded in parallel.
2. The editing time will be cut substantially compared with the "stop-go" approach.
3. The editing task and user-interface will be simplified to just picking which camera is "live" or active at certain time.

Conclusions

It is possible to bring the benefits of vicarious learning to individual educators but there are some significant problems and issues that still need to be addressed in order to implement the most effective support for such method of learning and teaching. Producing video-based educational multimedia is more than just pointing a video camera and shooting. Empirical works reported in this paper support the notion that perceived quality of production is significantly affected by the number of camera angles that are used in

the production. While the current range of video-editing software packages have the features to produce video-based educational multimedia material of sufficient quality, the tasks in which they demand the user to go through in order to produce such materials are not compatible with the way the lecturer actually needs to work. To make video-editing packages usable in the educational context, the editing task needs to be both quicker and easier. As the number of camera angles in production affects the perceived quality of that production, packages need to support the use of multiple camera angles in productions without forcing the user into a "stop-go" style of interaction to edit videos – this is currently a significant usability bottleneck for users of these packages.

There is currently no large-scale empirical data on how students interact with vicarious learning materials. More importantly, there are no data on how the interaction pattern is affected when there are pedagogic shortfalls resulting from production problems, e.g., missing out vital contents through using insufficient camera angles. These variables are independent from the usual variables investigated in video technology, such as bandwidth, resolution and synchronization. This needs to be thoroughly investigated as pedagogic effectiveness is at stake.

References

Armer A. (1990), *Directing Television and Film* . 2nd Edition. Wadsworth Publishing Company, California

Hughes J. and Sasse M.A. (1997) Internet Multimedia Conferencing - Results from the ReLaTe Project. *Proceedings of ICDE World Conference*, Pennsylvania, 1997

Laurillard, D. (2002). *Rethinking University Teaching: A Framework for the Effective Use of Learning Technology*. London, RoutledgeFalmer

Lee, J., F. Dineen, et al. (1998). "Supporting Student Discussions: It Isn't Just Talk." *Education and Information Technology***3**: 217-229.

Lee, J., F. Dineen, et al. (1999). Vicarious Learning cognitive and linguistic effects of observing peer dialogues. *American Educational Research Association (AERA '99) Annual Meeting.*

Mayes, J. T. and C. J. H. Fowler (1999). Learning technology and usability: a framework for understanding courseware. *Interacting with Computers* **11**: 485-97.

McKendree, J., K. Stenning, et al. (1998). Why Observing A Dialogue May Benefit Learning: The Vicarious Learner. *Journal of Computer Assisted Learning* **14**(2): 110-119.

Pennel, R. (1996). Essential Aspects of the Teaching-Learning Process. http://edtech.nepean.uws.edu.au/mmn8/laurillard.html. , Educational Technology Centre, UWS Nepean. Accessed on 24/06/2000

Reeves, B. and Nass, C. (1996). *The Media Equation: how people treat computers, television, and new media like real people and places.* New York: CSLI Publications.

Stenning, K., J. McKendree, et al. (1999) Vicarious Learning from Educational Dialogue. *Proceedings of CSCL1999* (Palo Alto, California, December 1999), Lawrence Erlbaum Associates, Mahwah, NJ.

Tulving, E. (1983). *The Elements of Episodic Memory.* NewYork: Oxford University Press.

Watson, A. and Sasse M.A. (2000) The Good, the Bad, and the Muffled: the Impact of Different Degradations on Internet Speech in *Proceedings of ACM Multimedia 2000* , Los Angeles, California, October 30 – November 4 2000, 269-276

Watts, H., (1997) *On Camera: Essential Know-how for programme-makers*. Lontec, Borehamwood, Herts.

Wenger E and Snyder. WM. (2000). *Communities of Practice: The Organizational Frontier* . Harvard Business Review, Jan-Feb, pp 139-145

Classroom2000 Project at http://www.cc.gatech.edu/fce/eclass/index.html Georgia Institute of Technology

The Dissemination System at http://www.hcrc.ed.ac.uk/Vicar/TT/ at Heriot-Watt University, UK

The Computers in Teaching and Learning course was a module of an MSc in Human Computer Interaction

Human Communications 1h: at http://www.cogsci.ed.ac.uk/school/study/ug/hc1h/

A first year undergraduate course taught at HCRC (University of Edinburgh).

MIMIO Whiteboard at http://www.mimio.com/

ReLaTe at http://www.ex.ac.uk/pallas/relate/
ReLaTe is developing and testing video conferencing software for use in language teaching. It is a joint project between the University of Exeter and University College London (UCL).

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

[X] This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

[ ] This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").